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Thesis

WHAT ARITHMETIC DO CHILDREN USE IN THEIR OUT-OF-SCHOOL LIFE?

Submitted by

Elmer E. Ellsworth
(B.S., Columbia University, 1926)

In partial fulfillment of requirements for

the degree of Master of Education

1939

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TABLE OF CONTENTS

CHAPTER		PAGE
I	Statement of Problem and Introduction	1
II	Procedure Used in Conducting the Study and Compiling the Data	4
III	Explanation of the Organization of the Data	7
IV	The Data and Their Meaning	8
	Resume Based on Total for All Grades	8
	Resume of Total for All Sixth Grades	12
	Resume of Total for All Fifth Grades	15
	Resume of Total for All Fourth Grades	18
	Resume of Total for All Third Grades	21
	Resume of Grade Six Data (L)*	24
	Resume of Grade Six Data (R)*	27
	Resume of Grade Six Data (O)*	30
	Resume of Grade Five Data (S)*	33
	Resume of Grade Five Data (K)*	36
	Resume of Grade Five Data (B)*	40
	Resume of Grade Four Data (E)*	43
	Resume of Grade Four Data (S)*	46
	Resume of Grade Four Data (N)*	49
	Resume of Grade Four Data (C)*	52
	Resume of Grade Three Data (Q)*	55

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

TABLE OF CONTENTS (Concluded)

CHAPTER PAGE

IV (Concluded)

Resume of Grade Three Data (M)* 58

V Conclusions 61

VI Bibliography 62

VII Appendix 64

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

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https://archive.org/details/whatarithmeticdo00ells

LIST OF TABLES

TABLE PAGE

1 Items, Frequency, and Percentages for Total Study 10

2 Items, Frequency, and Percentages for All Sixth Grades .. 13

3 Items, Frequency, and Percentages for All Fifth Grades .. 16

4 Items, Frequency, and Percentages for All Fourth Grades . 19

5 Items, Frequency, and Percentages for All Third Grades .. 22

6 Items, Frequency, and Percentages for One Sixth Grade (L)* 25

7 Items, Frequency, and Percentages for One Sixth Grade (R)* 28

8 Items, Frequency, and Percentages for One Sixth Grade (O)* 31

9 Items, Frequency, and Percentages for One Fifth Grade (S)* 34

10 Items, Frequency, and Percentages for One Fifth Grade (K)* 38

11 Items, Frequency, and Percentages for One Fifth Grade (B)* 41

12 Items, Frequency, and Percentages for One Fourth Grade (E)* 44

13 Items, Frequency, and Percentages for One Fourth Grade (S)* 47

14 Items, Frequency, and Percentages for One Fourth Grade (N)* 50

15 Items, Frequency, and Percentages for One Fourth Grade (C)* 53

---

*Letter in parenthesis is the initial of the last name of the classroom teacher.

LIST OF TABLES (Concluded)

TABLE PAGE

16 Items, Frequency, and Percentages for One Third Grade (Q)* 56

17 Items, Frequency, and Percentages for One Third Grade (M)* 59

---

*Letter in parenthesis is the initial of the last name of the classroom teacher.

LIST OF GRAPHS

FIGURE PAGE

1 Items and Percentages for Total Study 11

2 Items and Percentages for All Sixth Grades 14

3 Items and Percentages for All Fifth Grades 17

4 Items and Percentages for All Fourth Grades 20

5 Items and Percentages for All Third Grades 23

6 Items and Percentages for One Sixth Grade (L)* 26

7 Items and Percentages for One Sixth Grade (R)* 29

8 Items and Percentages for One Sixth Grade (O)* 32

9 Items and Percentages for One Fifth Grade (S)* 35

10 Items and Percentages for One Fifth Grade (K)* 39

11 Items and Percentages for One Fifth Grade (B)* 42

12 Items and Percentages for One Fourth Grade (E)* 45

13 Items and Percentages for One Fourth Grade (S)* 48

14 Items and Percentages for One Fourth Grade (N)* 51

15 Items and Percentages for One Fourth Grade (C)* 54

16 Items and Percentages for One Third Grade (Q)* 57

17 Items and Percentages for One Third Grade (M)* 60

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

CHAPTER I

STATEMENT OF PROBLEM AND INTRODUCTION

What Arithmetical Knowledges Do Children Use in Their Out of School Life?

According to available reference material[1,3,10]* concerning research in education, much interest has been shown recently in the subject of arithmetic. This phase of the school curriculum has been studied and attacked from many angles. Some of our educators are still struggling to vindicate the study of arithmetic for its disciplinary value, advocating material and processes entirely without the experience of the child. Others, realizing that, after all, we should be teaching children and not subject matter, are developing and studying problems in research in an attempt to determine that arithmetic which is of actual use and value in our modern civilization. An increasingly encouraging number of these studies have been completed and more are under way.

One of the earliest studies[13] along the line of eliminating useless arithmetic was made in 1918 and attracted nation-wide attention. The findings of that study, with additional data secured from other research material and theses, were printed in book form in 1926.[14]

Since then, various studies have been made in the field of arithmetic showing quite conclusively that our pupils have been compelled

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*Reference indexes refer to numbered Bibliography.

to learn many more kinds of arithmetic than in all probability they will ever use. One of the earlier studies [15] on occupational arithmetic demonstrates the comparatively small amount of computational arithmetic necessary to adult life. One more recent study [5] concerning fractions showed that five different fractions comprised 95 5/10 per cent of all fractions used by adults in big business. Another study reveals how little used are some of the measures which are taught in school, as well as the wide variation of knowledge concerning measures as a whole. [12] Another research discussed problems brought in from home by children and indicated that a comparatively small amount of arithmetic knowledge was needed to solve them.[7]

These studies, with exceptional instances here and there, have dealt with adult knowledge and adult needs. As yet, there is very little knowledge as to what arithmetic children, in a normal life situation, use and have use for, as children.

Where research on child arithmetic has been done, the results all seem to point in the same direction. The findings in every case indicate that much less arithmetic is used or needed than is taught in the ordinary public school. A survey of first grade entering children [2] showed an interesting variety of arithmetical knowledge and use. A study made in 1919 of the out-of-school use for arithmetic of fourth, fifth, and sixth grade children brought out the fact that a knowledge of counting, reading numbers, and United States money took care of nearly all the needs of these children for arithmetic. A very recent study [11] of the computational arithmetic used by a group of third grade children showed that very simple addition and subtraction

examples were performed, and that United States money played an important part in their arithmetic procedures.

Therefore, this study is another attempt to find out what kinds of arithmetical knowledge children in grades three through six actually use in their out-of-school life.

CHAPTER II

PROCEDURE USED IN CONDUCTING THE STUDY AND COMPILING THE DATA

In order to conduct this survey, it was decided to enlist the aid and cooperation of the pupils and teachers of 12 grades from the third to sixth, including two third, four fourth, three fifth, and three sixth grades, 390 pupils participating. The general idea of the study was presented to the 12 teachers, who became very interested and offered their unqualified support in the project.

The method of securing data for this study was determined through discussion of various types of procedure with the participating teachers. After discussing and evaluating different means, it was decided that the best method in this case would be a combination questionnaire-pupil reporting method.

All phases of the uses of numbers were discussed, some accepted and some discarded, with the final result being a report form of 17 items for the pupil to check each day. (See Exhibit I in Appendix) This list of arithmetical usages was considered, by the teachers, to include those phases of arithmetic which children of third to sixth grade might use. The final reports as turned in by the pupils showed no additional usages.

Each grade teacher and the investigator then presented in very

simple language and at great length the proposition to the pupils as follows:

Each pupil was to use the reporting form as a place on which to record the number of times each day he used any phase of arithmetic. It was explained very carefully and often that school work of an arithmetical nature did not count at all or at any time. Every day the teacher, and as often as possible, the investigator, checked on the data turned in on the form, thus cutting down somewhat, at least, unreliable or erroneous information.

The classes varied somewhat in size and in the time used for the study, and no attempt was made to make control groups or experimental groups. Classes were heterogeneous and varied greatly in different schools, and in most of the groups there was a considerable range in I.Q.'s.

At the conclusion of the time allowed (ranging from one to three weeks) all reports were collected, and the tabulation was begun. First, the figures of each individual report sheet were added and totalled. Then all the figures of each class were added and totalled. Following this, the totals of all the classes of one grade were compiled. From these totals the grand total of all grades was secured. The next procedure was to determine the percentage of each item as it occurred in each class, each total grade, and for the entire group of all grades. In every case, the percentage was carried to at least three decimal places.

After this information was secured, the next step was to present the data by means of tables and graphs.

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All the time that the information was being collected from the pupils, as noted above, the investigator and class room teachers concerned checked and questioned items submitted by children. Many notes regarding unusual situations or unexpected occurrences were taken in order to explain any such apparent discrepancies that might appear in the compiled data.

CHAPTER III

EXPLANATION OF THE ORGANIZATION OF THE DATA

In the following pages will be found a breakdown of the data secured according to grades and classes. For each group the data are summarized and reported in three forms:

1. A statement about the information which was found concerning that grade or class.
2. A table showing the frequency of occurrence and the percentage of frequency for each item arranged in an order of occurrence determined by the total findings. (See Table I, Page 10)
3. A graphical figure showing the frequency of occurrence of each item for the grade or class as shown in the immediately preceding table. (See Figure I, Page 11)

The first table, Table I, Page 10, is a table of totals. This table tells the final story in that it is a summary table; but it also becomes a key table for comparison. In other words, by giving the total table to the reader at once, it is possible then to compare or refer back constantly to Table I as a basis of reference. The order of items in this summary table is kept in tables covering classes or grades.

Figure I, Page 11, is a graphical representation showing the items and percentages expressed in Table I.

CHAPTER IV

THE DATA AND THEIR MEANING

Resume based on totals for all grades.-- A total of 53,163 arithmetical usages was reported by the 390 participating pupils in all grades. These data are summarized in Table I, Page 10. Of the total number of usages, 14,461 or 27.201 per cent refer to "telling time", and 8,262 or 15.541 per cent refer to "using U.S. money". This latter is a sharp drop from the first item and seems to be indicative of the fact that "telling time" is the most common usage of arithmetic with all children, at least from third grade up.

The cosmopolitan make-up of the classes may account for "using U.S. money" being second on the list, as many of the children in this study do a great deal of shopping for their parents as well as for themselves.

The third item, "counting", occurring 7,196 times or 13.536 per cent is accounted for by the numerous counting games engaged in by children of these grade ages. In fact, investigation showed that this item should have been second since, upon questioning, many of the children admitted that they hadn't thought of recording some of their games in which they counted, as "counting".

"Reading numbers" comes next with a frequency of occurrence of 6,988, or 13.144 per cent of the total. Then another sharp drop takes

place when 4,454 usages or 8.378 per cent are recorded for "writing numbers". This condition appears natural in that all of us read numbers much more than we write them. "Roman numerals" were found in chapter headings, clock faces, public building inscriptions, etc. The "addition of whole numbers", occurring 2,822 times or 5.308 per cent of the total, is rather surprising, as many people have assumed that adding, even with children, is very common.

From the next item of "measuring length" occurring 1,528 times, to the item of least frequency, "multiplying fractions" occurring only 14 times, there is a gradual descent in the frequency of occurrence. The low percentage of .026 per cent referring to "multiplication of fractions" would seem to indicate that the time spent in teaching this phase of arithmetic and the amount of usage of it by children is disproportionate to say the least.

Figure I shows graphically the items of Table I in order of frequency with corresponding percentages.

Table 1. Showing the Seventeen Items, the Total Frequency of Each Item, and the Percentage That Each Item Is of the Total.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time..................	14461	27.201
2. Using U.S. Money.............	8262	15.541
3. Counting......................	7196	13.536
4. Reading Numbers..............	6988	13.144
5. Writing Numbers..............	4454	08.378
6. Roman Numerals...............	4039	07.597
7. Adding Whole Numbers.........	2822	05.308
8. Measuring Length.............	1528	02.874
9. Measuring Weight.............	1055	01.984
10. Subtracting Whole Numbers....	1000	01.881
11. Multiplying Whole Numbers....	593	01.115
12. Dividing Whole Numbers.......	516	00.971
13. Adding Fractions.............	169	00.318
14. Measuring Area...............	25	00.047
15. Dividing Fractions...........	23	00.043
16. Subtracting Fractions........	18	00.034
17. Multiplying Fractions........	14	00.026
Total	53163	99.998

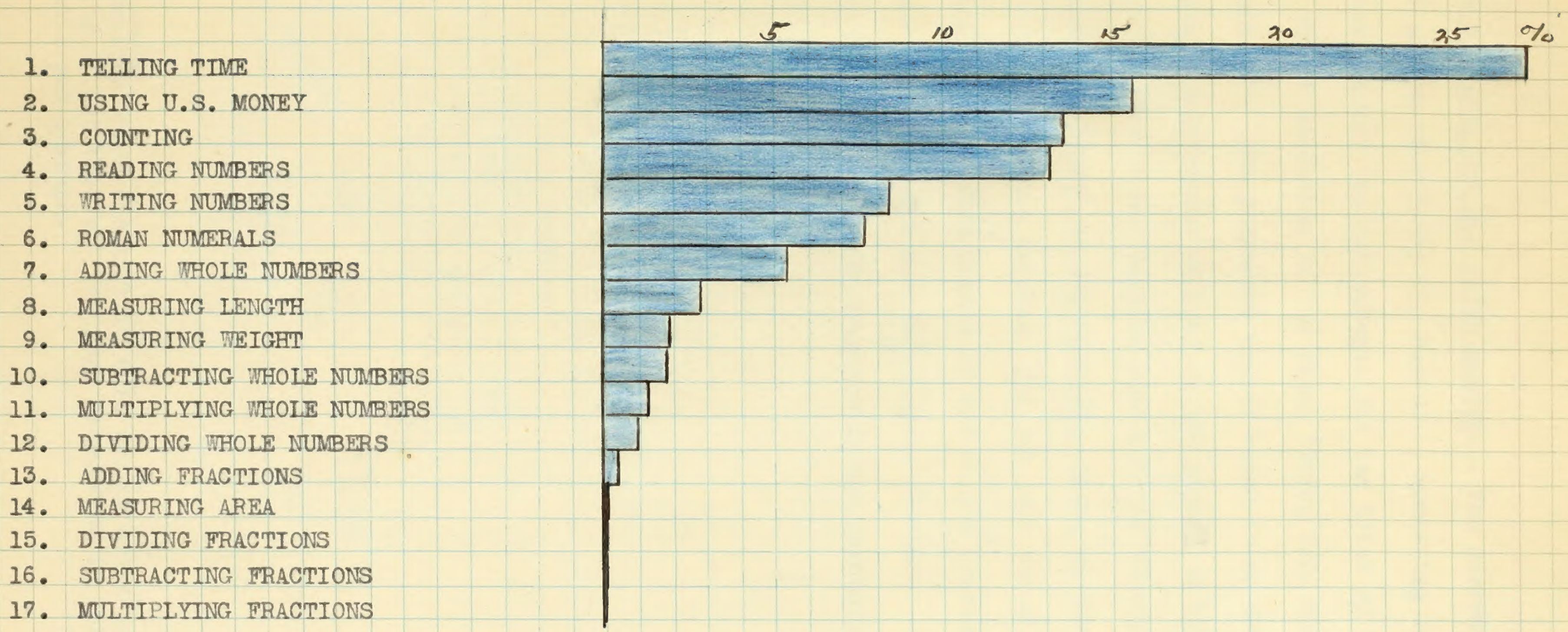

Figure 1. Showing graphically the items and percentage of Table I, as pertaining to all grades.

Resume of total for all sixth grades.-- The percentages for the three sixth grades (See Table II, Page 13), numbering 101 pupils, follow rather closely the percentages for the total of all children. There is a slight deviation in the items "using U.S. money" and "writing numbers". The decreased use of money is no doubt explainable by the economic environment of many of the pupils in the sixth grade. The variation in the items "writing numbers" and "Roman numerals" is noted without any attempt at explanation. Also, in the item "adding fractions", the difference between .318 per cent for all grades and .091 per cent for all sixth grades is due to the frequency of occurrence of this item in one of the fifth grade classes.

Figure II, Page 14, shows graphically the percentages expressed in Table II.

These incomplete pages are left in this way in order to facilitate the easy reading of the thesis. The page discussion is followed immediately by a table and a graph.

Table 2. Showing for the Three Sixth Grades, 101 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of One to Three Weeks. Percentage of Total Figured for Each Item.

		Frequency	Percentages
	(1)	(2)	(3)
1.	Telling Time.................	4123	28.774
2.	Using U.S. Money............	2404	16.777
3.	Counting....................	2420	16.889
4.	Reading Numbers.............	1825	12.736
5.	Writing Numbers.............	890	06.211
6.	Roman Numerals..............	913	06.372
7.	Adding Whole Numbers........	706	04.927
8.	Measuring Length............	367	02.561
9.	Measuring Weight............	301	02.101
10.	Subtracting Whole Numbers...	202	01.410
11.	Multiplying Whole Numbers...	88	00.614
12.	Dividing Whole Numbers......	51	00.355
13.	Adding Fractions............	13	00.091
14.	Measuring Area..............	6	00.042
15.	Dividing Fractions..........	5	00.035
16.	Subtracting Fractions.......	5	00.034
17.	Multiplying Fractions.......	10	00.070
	Total	14329	99.999

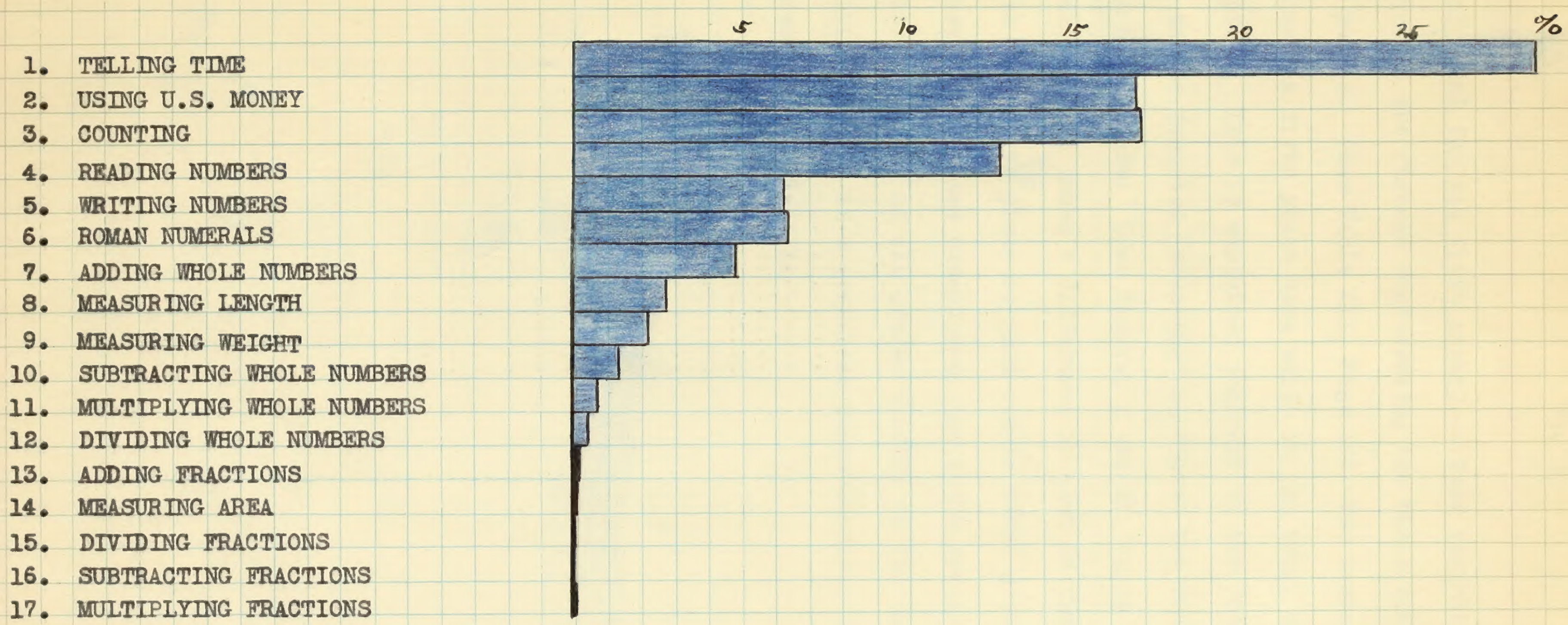

Figure 2. Showing graphically the items and percentage of Table II, as pertaining to the three sixth grades.

Resume of total for all fifth grades.-- Some variations from the total are found in the figures representing the three fifth grades, numbering 96 pupils. (See Table III, Page 16) For instance, "counting" comes in fifth place here while in the total summation it is in third place. This is explained somewhat by the fact that two of the fifth grades reported "counting" in fourth and fifth place instead of in third place. (See Figures X and XI, Pages 39 and 42) "Measuring weight" also shows a difference in that in the fifth grade total it falls to twelfth place as compared to ninth place for all grades combined. With these exceptions, the fifth grades grouped together follow the total of all grades exactly in the same order.

Figure III, Page 17, is a graphical representation of the percentages expressed in Table III.

Table 3. Showing for Three Fifth Grades, 96 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of One to Three Weeks. Percentage of Total Figured for Each Item.

(1)	Frequency (2)	Percentages (3)
1. Telling Time.................	4198	25.050
2. Using U.S. Money............	2357	14.065
3. Counting....................	1604	09.572
4. Reading Numbers.............	1911	11.403
5. Writing Numbers.............	1743	10.401
6. Roman Numerals..............	1465	08.742
7. Adding Whole Numbers........	1031	06.152
8. Measuring Length............	558	03.339
9. Measuring Weight............	208	01.241
10. Subtracting Whole Numbers...	520	03.104
11. Multiplying Whole Numbers...	488	02.912
12. Dividing Whole Numbers......	465	02.774
13. Adding Fractions............	156	00.931
14. Measuring Area..............	19	00.113
15. Dividing Fractions..........	18	00.107
16. Subtracting Fractions.......	13	00.078
17. Multiplying Fractions.......	4	00.024
Total	16758	99.999

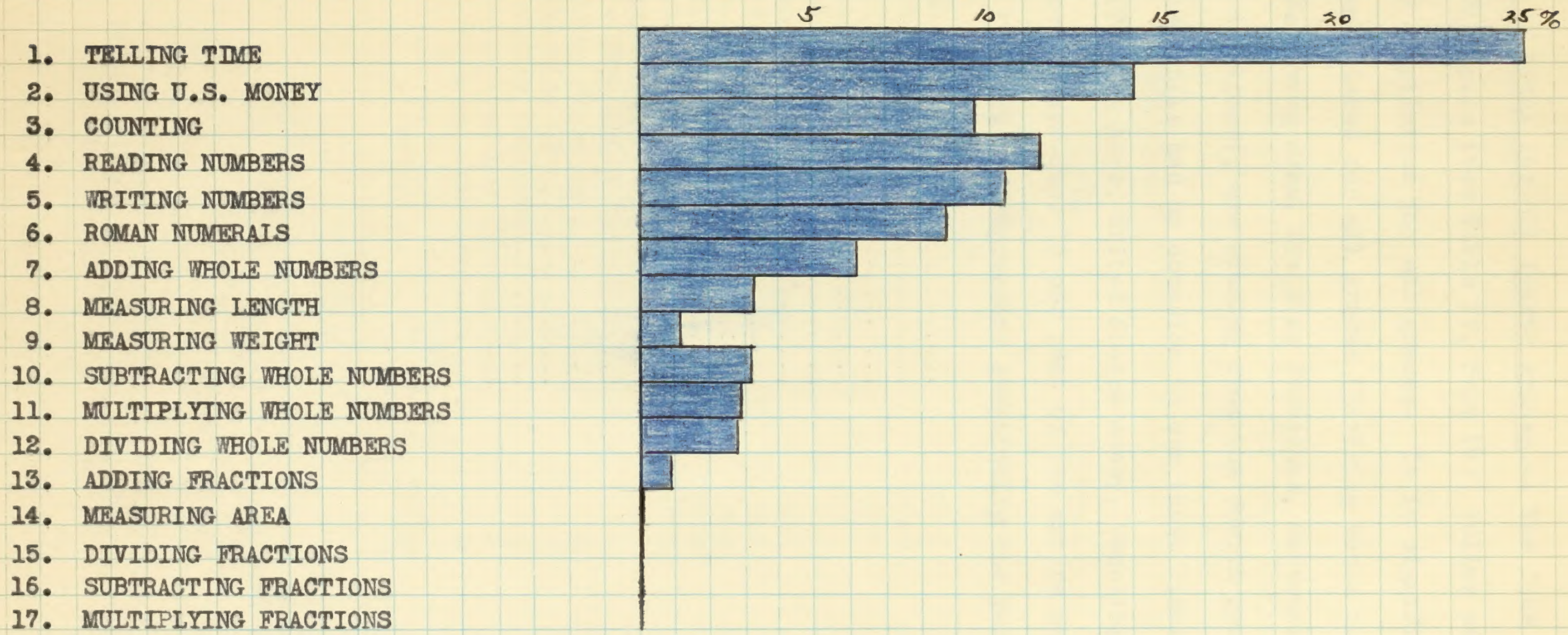

Figure 3. Showing graphically the items and percentage of Table III, as pertaining to the three fifth grades.

Resume of total for all fourth grades.-- The four fourth grades, numbering 131 pupils (See Table IV, Page 19), follow exactly the order shown in the compilation for all grades. It is significant that the last six items listed for all grades (Dividing whole numbers, Adding fractions, Measuring area, Dividing fractions, Subtracting fractions, Multiplying fractions), are missing from the fourth grade list, as evidently the pupils had no occasion to use these items. The first four items (Telling time, United States money, Counting, and Reading numbers), account for over 70 per cent of the entire usage.

Figure IV, Page 20, represents graphically the percentages shown in Table IV.

Table 4. Showing for Four Fourth Grades, 131 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of One to Three Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time................	5021	28.703
2. Using U.S. Money............	2769	15.829
3. Counting....................	2606	14.897
4. Reading Numbers.............	2521	14.411
5. Writing Numbers.............	1473	08.421
6. Roman Numerals..............	1290	07.374
7. Adding Whole Numbers........	859	04.910
8. Measuring Length............	340	01.944
9. Measuring Weight............	208	01.824
10. Subtracting Whole Numbers...	278	01.589
11. Multiplying Whole Numbers...	17	00.097
12. Dividing Whole Numbers......	0	.000
13. Adding Fractions............	0	.000
14. Measuring Area..............	0	.000
15. Dividing Fractions..........	0	.000
16. Subtracting Fractions.......	0	.000
17. Multiplying Fractions.......	0	.000
Total	17493	99.999

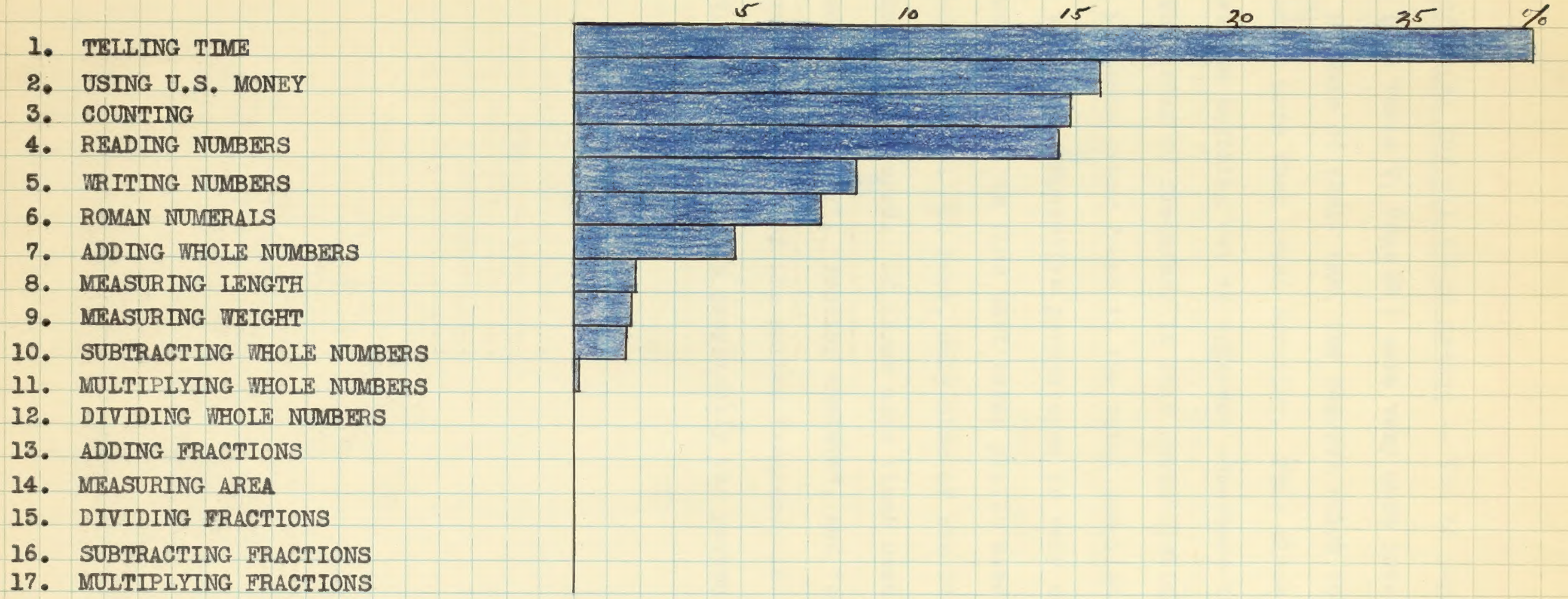

Figure 4. Showing graphically the items and percentage of Table IV, as pertaining to the four fourth grades.

Resume of total for all third grades.-- The 62 pupils in the two third grades (See Table V, Page 22) were very much interested in the experiment. Because of their age, the reports which they turned in were subjected to more than usual scrutiny. This close check, however, failed to disclose anything but an apparent adherence to the prescribed procedure. The order of frequency in this grade listing does not follow quite the same order found in the total compilation, but the variation in terms of comparative percentages is very small. Here, as in the fourth grades, we find that these pupils used only part of the list of usages given. In fact, only nine of the 17 items were reported as having been used. Of these nine items used, "telling time", "United States money", "reading numbers", and "counting" represents over 66 per cent of the entire frequency in this table.

Figure V, Page 23, represents graphically the percentages as shown in Table V.

Table 5. Showing for Two Third Grades, 62 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of One to Three Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(2)
1. Telling Time.................	1119	24.416
2. Using U.S. Money............	732	15.972
3. Counting....................	566	12.350
4. Reading Numbers.............	731	15.950
5. Writing Numbers.............	348	07.593
6. Roman Numerals..............	371	08.095
7. Adding Whole Numbers........	226	04.931
8. Measuring Length............	263	05.739
9. Measuring Weight............	227	04.953
10. Subtracting Whole Numbers...	0	.000
11. Multiplying Whole Numbers...	0	.000
12. Dividing Whole Numbers......	0	.000
13. Adding Fractions............	0	.000
14. Measuring Area..............	0	.000
15. Dividing Fractions..........	0	.000
16. Subtracting Fractions.......	0	.000
17. Multiplying Fractions.......	0	.000
Total	4583	99.999

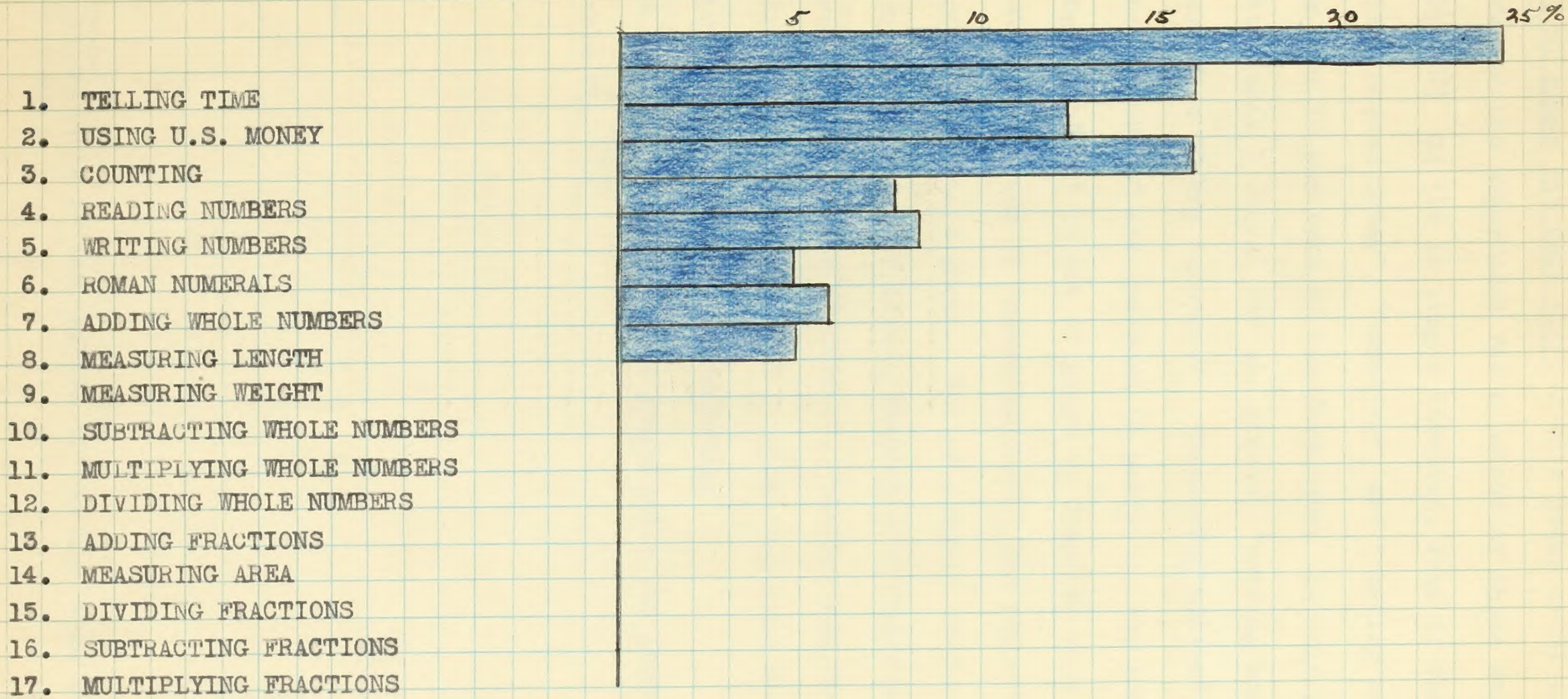

Figure 5. Showing graphically the items and percentage of Table V, as pertaining to the two third grades.

Resume of grade six data (L)*.-- This group of 34 sixth grade pupils conducted the experiment for a period of three weeks. (See Table VI, Page 25) Of the 16 usages involved, four of them, "telling time", "United States money", "counting", and "reading numbers", account for over 75 per cent of the frequency. In this grade, as compared with Table I (total for all grades) "writing numbers" occurs slightly less than "Roman numerals". "Measuring weight" and "subtracting whole numbers" are reversed in position, and the item "multiplying fractions" is out of place as compared with Table I. It is noted that the item of "measuring area" was reported as not occurring at all with this group. Out of a total frequency of 6,352 for all items, the last four items, dealing with fractions, occurred only 31 times. "Multiplying fractions", "subtracting fractions", and "dividing fractions", were reported by girls who used cooking recipes and boys who were dealing with woodworking.

Figure VI, Page 26, represents graphically the percentage as shown in Table VI.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 6. Showing for a Sixth Grade, (L)*, 34 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Three Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time..................	1680	26.448
2. Using U.S. Money.............	1152	18.136
3. Counting......................	1149	18.088
4. Reading Numbers..............	903	14.215
5. Writing Numbers..............	344	5.415
6. Roman Numerals...............	345	5.431
7. Adding Whole Numbers.........	314	4.943
8. Measuring Length.............	146	2.298
9. Measuring Weight.............	105	1.652
10. Subtracting Whole Numbers....	119	1.873
11. Multiplying Whole Numbers....	45	.708
12. Dividing Whole Numbers.......	19	.299
13. Adding Fractions.............	13	.204
14. Measuring Area...............	0	.000
15. Dividing Fractions...........	5	.079
16. Subtracting Fractions........	5	.079
17. Multiplying Fractions........	8	.125
Total	6352	99.993

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

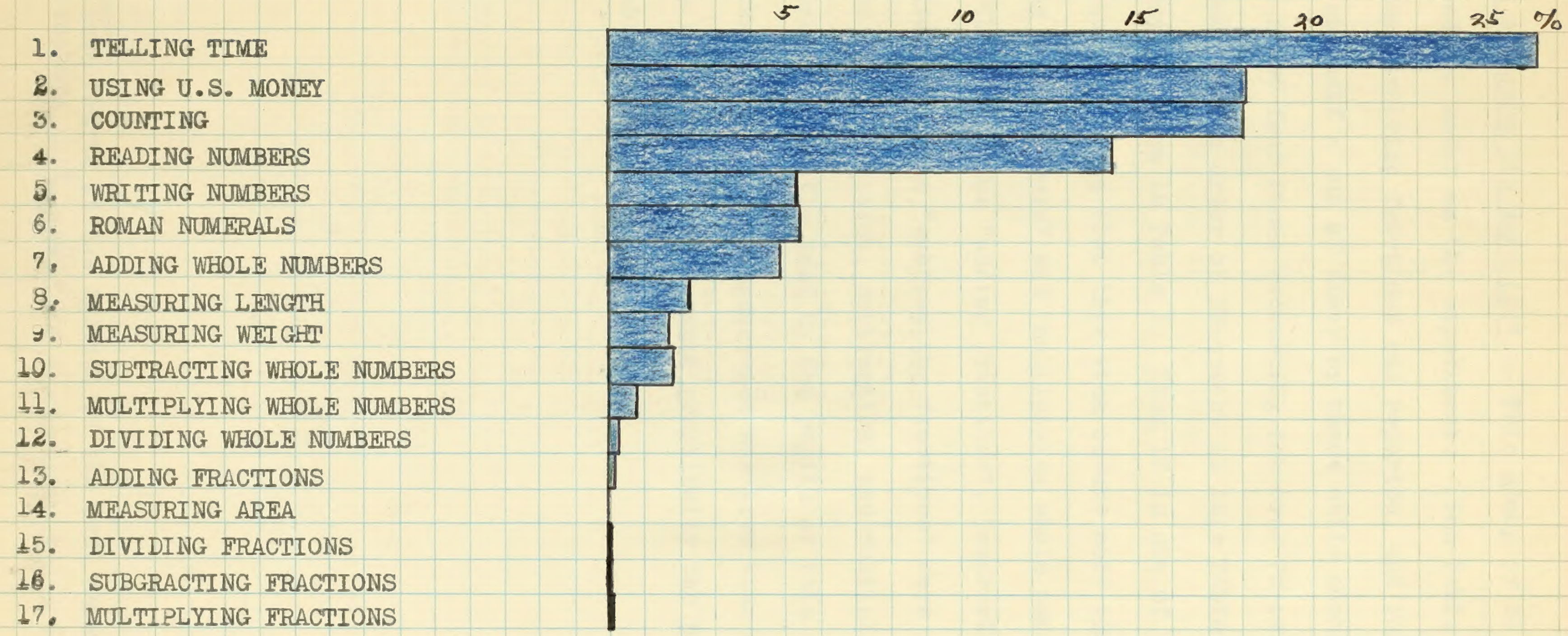

Figure 6. Showing graphically the items and percentage of Table VI, as pertaining to a sixth grade. (L)

Resume of grade six data (R)*.-- This group of 33 sixth grade pupils worked two weeks on the experiment. (See Table VII, Page 28) Only one case involving fractions was reported, and this by a girl who multiplied one-half a cup of flour by three while cooking. Here again we find the first four items accounting for over 75 per cent of the total frequency. The order of frequency in this Table follows closely the frequency as shown in Table I. Item 12 is out of place as compared with Table I in that this item occurs more times than "subtracting whole numbers" and "multiplying whole numbers". It is noted here that the items "adding fractions", "measuring area", "dividing fractions" and "subtracting fractions" were reported as not occurring at all. "Division, subtraction, and multiplication of whole numbers" were little used by the pupils of this grade, as in each case their frequency of occurrence was less than one per cent.

Figure VII, Page 29, represents graphically the percentages as shown in Table VII.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 7. Showing for a Sixth Grade, (R)*, 33 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time................	1200	33.324
2. Using U.S. Money............	750	20.827
3. Counting....................	522	14.495
4. Reading Numbers.............	383	10.635
5. Writing Numbers.............	229	6.359
6. Roman Numerals..............	198	5.498
7. Adding Whole Numbers........	122	3.387
8. Measuring Length............	75	2.082
9. Measuring Weight............	57	1.582
10. Subtracting Whole Numbers...	23	.638
11. Multiplying Whole Numbers...	14	.388
12. Dividing Whole Numbers......	27	.749
13. Adding Fractions............	0	.000
14. Measuring Area..............	0	.000
15. Dividing Fractions..........	0	.000
16. Subtracting Fractions.......	0	.000
17. Multiplying Fractions.......	1	.027
Total	3601	99.991

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

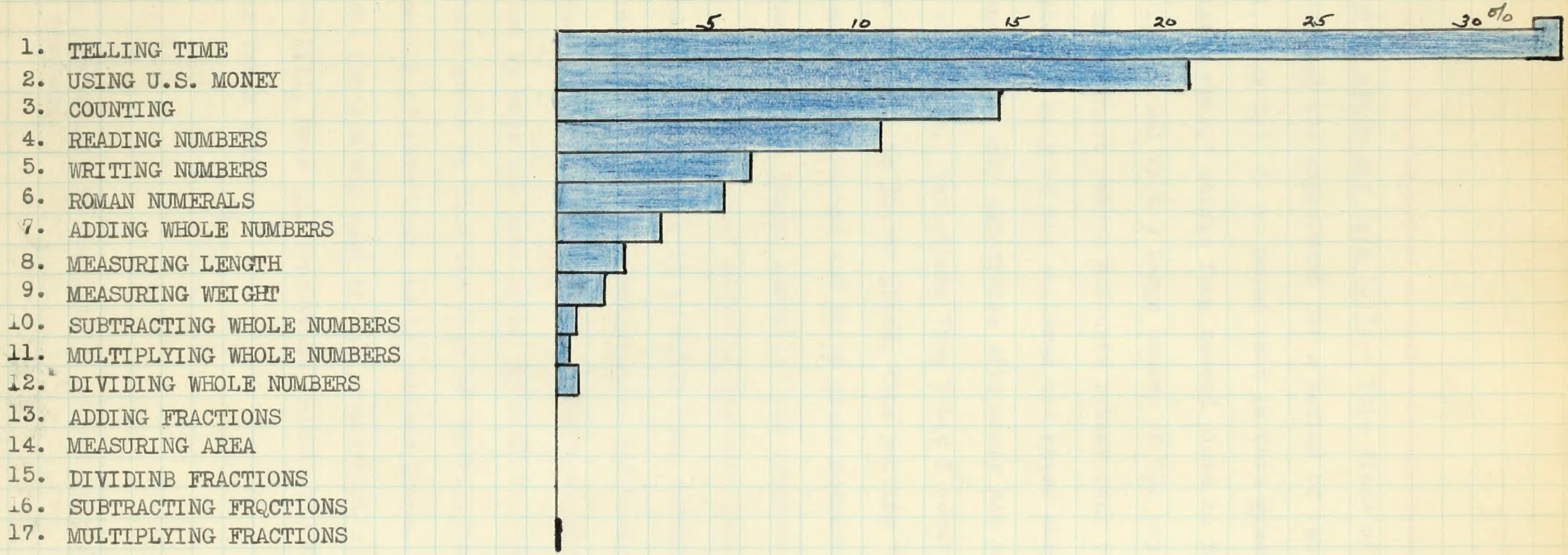

Figure 7. Showing graphically the items and percentage of Table VII, as pertaining to a sixth grade. (R)

Resume of grade six data (O)*.-- This class of 34 sixth grade pupils conducted the experiment for a period of two weeks. (See Table VIII, Page 31) It is noted that in this grade report that "United States money" shifts from second place to fourth place. Investigation showed that a large number of the pupils in this grade came from homes where charge accounts rather than cash transactions were prevalent. Many of the children had never shopped for their parents, and their only experience with money had been in spending their own allowance. Variations from Table I occur in item two of this table dropping to fourth place, thus putting "counting" and "reading numbers" in second and third place respectively. The items "writing numbers" and "Roman numerals" are reversed in order of frequency. "Measuring area" occurred one more time than "dividing whole numbers". Here again it is noted that certain items, namely, "adding fractions", "dividing fractions", and "subtracting fractions" are reported as not occurring at all. The item of "measuring area" was reported by boys who were doing woodwork in their homes, and again in this grade we find one case of "multiplying fractions". The explanation of this item, as in another grade, (See Table VII) is that this process was used in the preparation of a cooking recipe.

Figure VIII, Page 32, represents graphically the percentages as shown in Table VIII.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 8. Showing for a Sixth Grade, (O)*, 34 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time................	1243	28.404
2. Using U.S. Money............	502	11.471
3. Counting....................	749	17.116
4. Reading Numbers.............	539	12.317
5. Writing Numbers.............	317	7.244
6. Roman Numerals..............	370	8.455
7. Adding Whole Numbers........	270	6.170
8. Measuring Length............	146	3.336
9. Measuring Weight............	139	3.176
10. Subtracting Whole Numbers...	60	1.371
11. Multiplying Whole Numbers...	29	.662
12. Dividing Whole Numbers......	5	.114
13. Adding Fractions............	0	.000
14. Measuring Area..............	6	.137
15. Dividing Fractions..........	0	.000
16. Subtracting Fractions.......	0	.000
17. Multiplying Fractions.......	1	.022
Total	4376	99.995

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

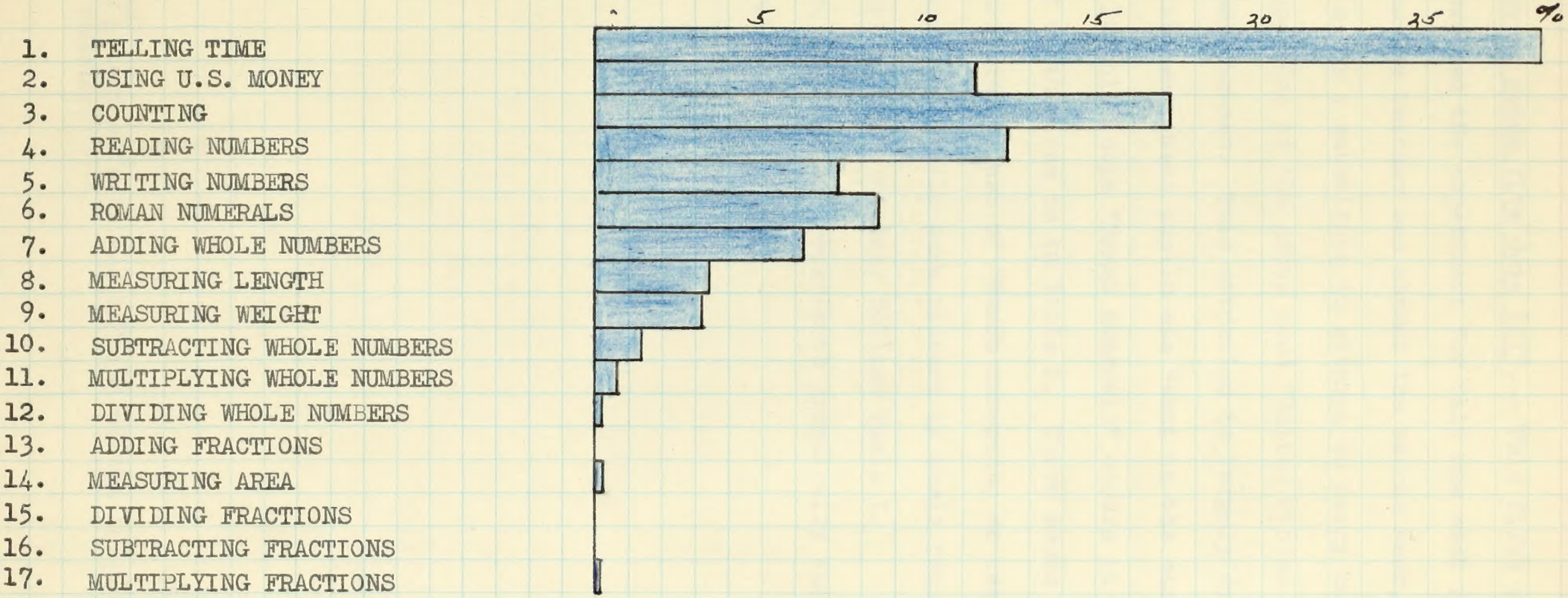

Figure 8. Showing graphically the items and percentage of Table VIII, as pertaining to a sixth grade. (0)

Resume of grade five data (S)*.-- This fifth grade class of 29 pupils conducted the experiment for only one week (See Table IX, Page 34) as the teacher was absent the second week, and it was felt inadvisable for a substitute to attempt to carry on the work. A larger proportion of the group used "United States money" than most of the other classes. This situation is largely due to the fact that in this class were many pupils who "went to the store" for their parents. In this table "Roman numerals" occurs in fourth place instead of sixth place as in Table I. There seems to be no explanation of this greater use of "Roman numerals, as inquiry seemed to indicate that the pupils were sincere in their report. Aside from this variation, the frequency follows Table I.

Figure IX, Page 35, represents graphically the percentages as shown in Table IX.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 9. Showing for a Fifth Grade, (S)*, 29 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of One Week. Percentage of Total Figured for Each Item.

(1)	Frequency (2)	Percentages (3)
1. Telling Time.................	365	22.912
2. Using U.S. Money............	315	19.774
3. Counting....................	235	14.752
4. Reading Numbers.............	184	11.550
5. Writing Numbers.............	123	07.721
6. Roman Numerals..............	214	13.433
7. Adding Whole Numbers........	94	05.900
8. Measuring Length............	63	03.954
9. Measuring Weight............	0	.000
10. Subtracting Whole Numbers...	0	.000
11. Multiplying Whole Numbers...	0	.000
12. Dividing Whole Numbers......	0	.000
13. Adding Fractions............	0	.000
14. Measuring Area..............	0	.000
15. Dividing Fractions..........	0	.000
16. Subtracting Fractions.......	0	.000
17. Multiplying Fractions.......	0	.000
Total	1593	99.996

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

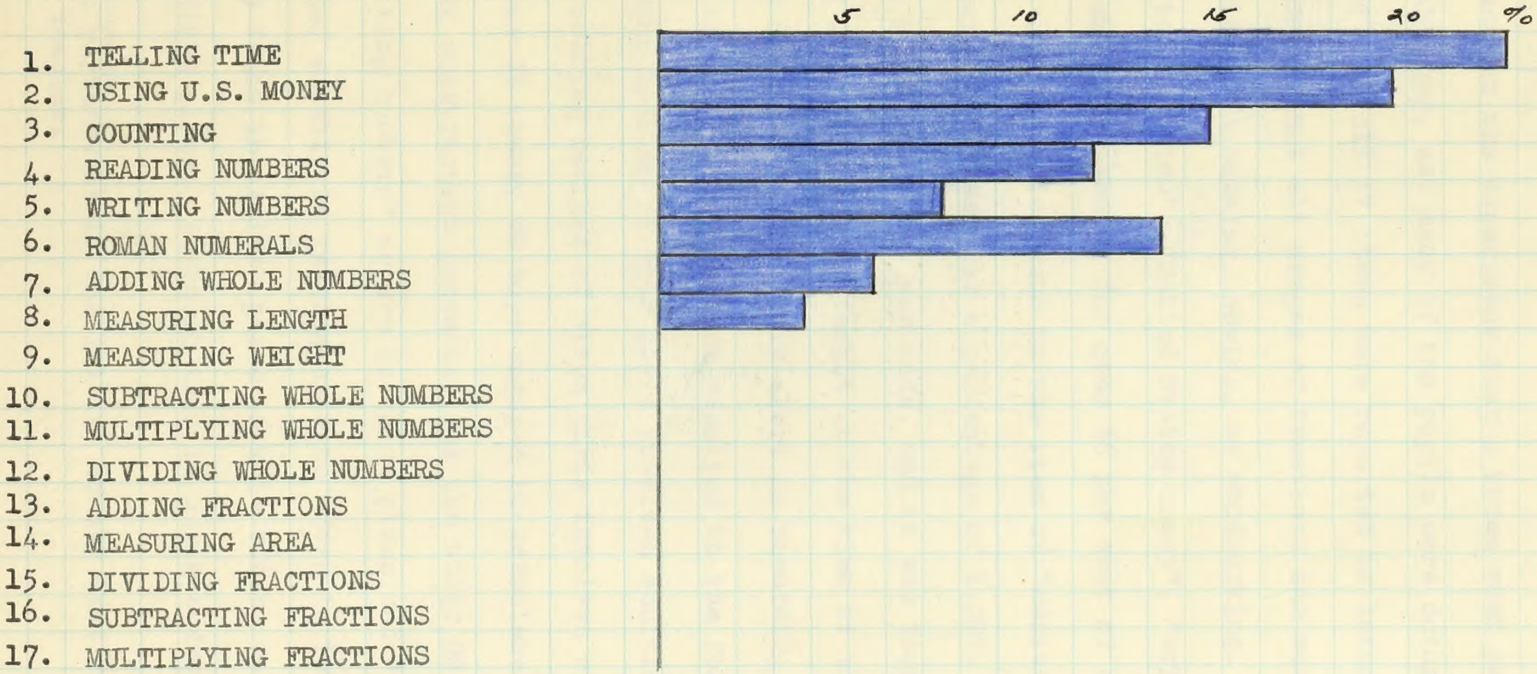

Figure 9. Showing graphically the items and percentage of Table lX, as pertaining to a fifth grade. (S)

Resume of grade five data (K)*.-- This larger group of 35 fifth graders (See Table X, Page 38) was taught by an unusually conscientious and interested teacher. They became so interested that they asked to conduct the experiment over a three week period. It was an accelerated group, and many of the pupils were doing sixth grade work. It is noted that all 17 items were reported as being used, and investigation showed that all usages of fractions and measurement of area occurred either in cooking, sewing, or woodworking. The first four items of "telling time", "United States money", "writing numbers", "reading numbers", account for over 56 per cent of all frequency. An unusual condition is found in the item of "addition of fractions" which occurred 155 times for a percentage of 1.397. As this seemed very high, a further check was made, and it was found that this particular process had been taught at the time of the experiment, and the pupils had been particularly alert in recording this process. A further breakdown of this item resulted in the following information: sewing problem of four girls involved addition of fractions 23 times; cooking recipes of seven girls involved use of addition of fractions 34 times; 12 boys engaged in aeroplane, boat, and other woodworking construction accounted for the other 98 usages. In this table "writing numbers" occurs in third place and "counting" in fifth place, exactly in reverse of data shown in Table I. "Measuring weight" is found in twelfth place in this table, while in Table I it is in ninth place. Although this is quite a drop, there seems to

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

be no explainable reason for it. "Measuring area", and "dividing fractions" are transposed in position although the difference is very slight.

Figure X, Page 39 , represents graphically the percentage as shown in Table X.

Table 10. Showing for a Fifth Grade, (K)*, 35 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Three Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time...............	2539	21.771
2. Using U.S. Money..........	1633	14.002
3. Counting..................	1020	8.746
4. Reading Numbers...........	1224	10.495
5. Writing Numbers...........	1329	11.395
6. Roman Numerals............	974	8.351
7. Adding Whole Numbers......	784	6.722
8. Measuring Length..........	446	3.824
9. Measuring Weight..........	163	1.397
10. Subtracting Whole Numbers.	467	4.004
11. Multiplying Whole Numbers.	444	3.807
12. Dividing Whole Numbers....	434	3.721
13. Adding Fractions..........	155	1.329
14. Measuring Area............	15	.128
15. Dividing Fractions........	18	.154
16. Subtracting Fractions.....	13	.111
17. Multiplying Fractions.....	4	.034
Total	11662	99.991

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

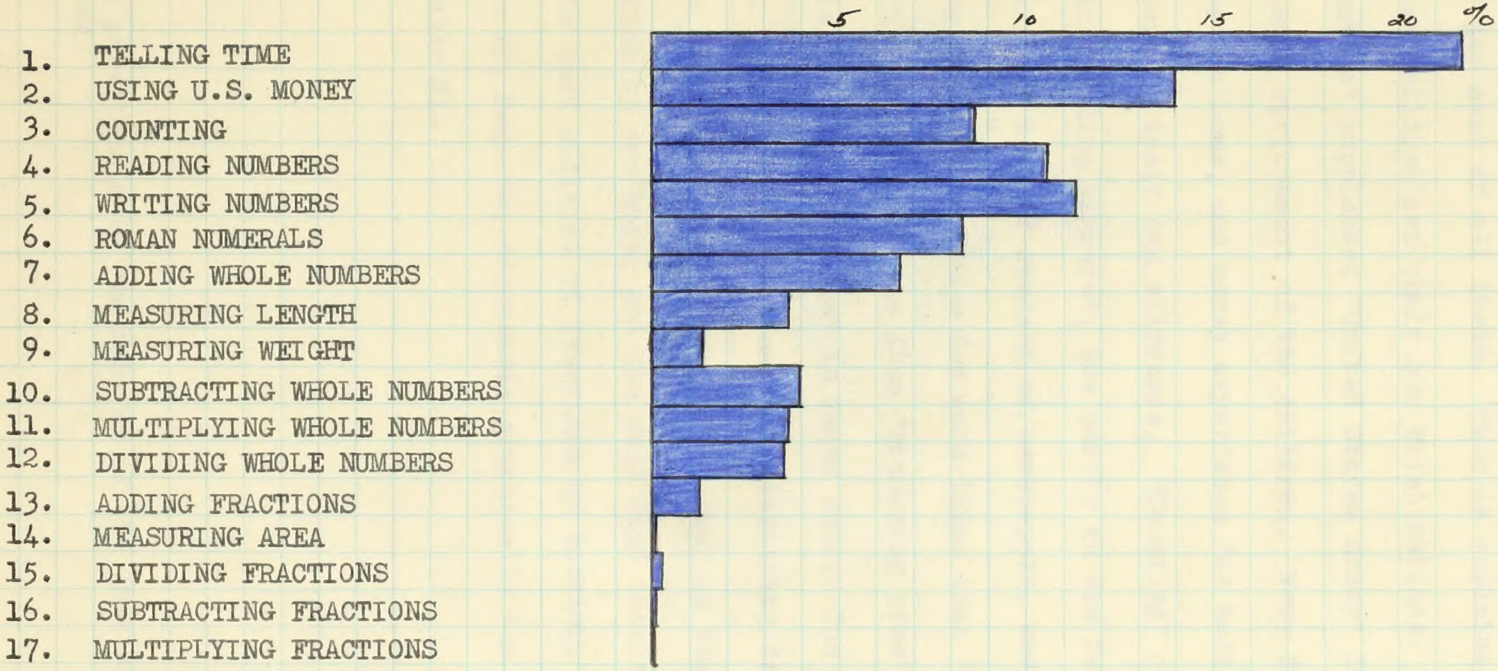

Figure 10. Showing graphically the items and percentage of Table X, as pertaining to a fifth grade. (K)

Resume of grade five data (B)*.-- This class of 32 pupils reported their arithmetical usages for two weeks. (See Table XI, Page 41) It is noted there is a very high frequency of occurrence of "telling time", 36.9 per cent of all items. This is explained by the fact that many of these children own their own wrist watches. In this group "reading numbers" supplanted "United States money" in second place due to the economic environment of the children. Very few of them did shopping for the home, and money experience for most of them was confined to spending their own allowance. "Counting" occurs less frequently than "reading numbers", due partly to the fact that these pupils do a great deal of reading of newspapers, magazines, etc. "Subtracting numbers" occurs a few more times than "measuring length", and "measuring weight" and the item "measuring area" are found four times, while "adding fractions" is found once. The items "dividing fractions", "subtracting fractions", "multiplying fractions" were reported as not being used. "Measuring area" in four cases was used in woodworking by two boys, and the only case involving fractions was one girl who used addition of fractions in cooking.

Figure Xl, Page 42, represents graphically the percentages as shown in Table Xl.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 11. Showing for a Fifth Grade, (B)*, 32 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

(1)	Frequency (2)	Percentages (3)
1. Telling Time................	1294	36.939
2. Using U.S. Money...........	409	11.676
3. Counting..................	349	9.962
4. Reading Numbers............	503	14.359
5. Writing Numbers............	291	8.307
6. Roman Numerals.............	277	7.907
7. Adding Whole Numbers.......	153	4.367
8. Measuring Length...........	49	1.398
9. Measuring Weight...........	45	1.284
10. Subtracting Whole Numbers..	53	1.512
11. Multiplying Whole Numbers..	44	1.256
12. Dividing Whole Numbers.....	31	.884
13. Adding Fractions...........	1	.029
14. Measuring Area.............	4	.114
15. Dividing Fractions.........	0	.000
16. Subtracting Fractions......	0	.000
17. Multiplying Fractions......	0	.000
Total	3503	99.994

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

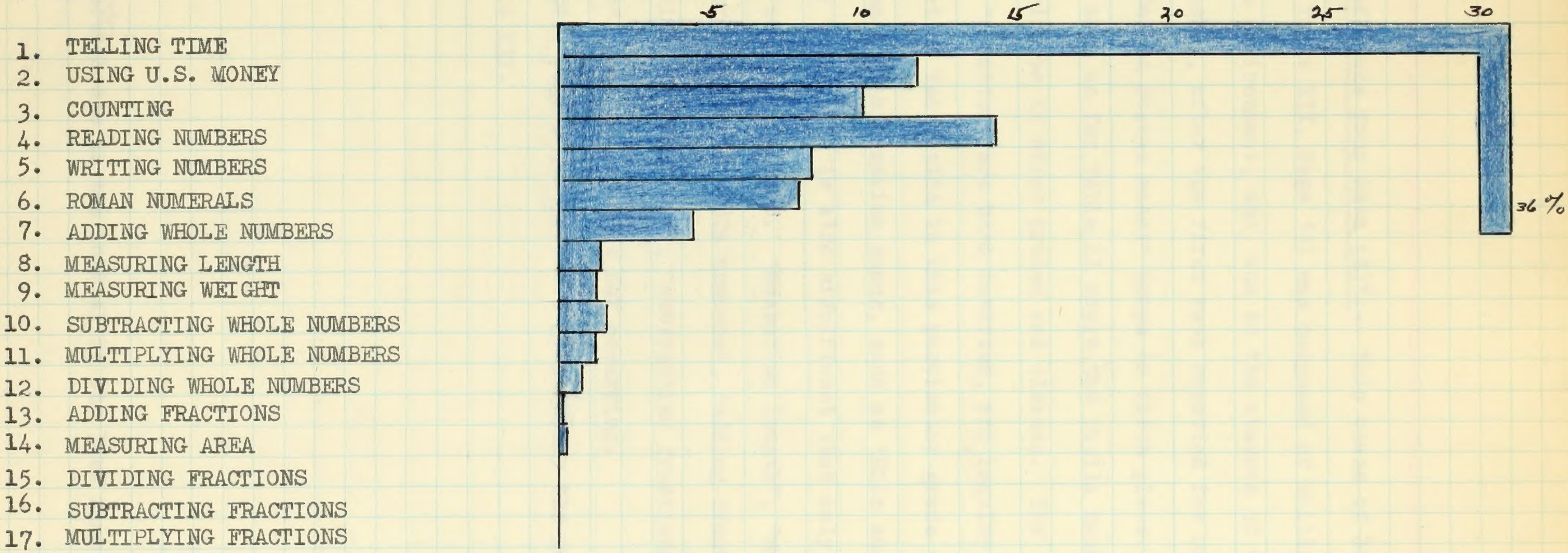

Figure 11. Showing graphically the items and percentage of Table X1, as pertaining to a fifth grade. (B)

Resume of grade four data (E)*.-- This class of 34 fourth grade pupils, (See Table XII, Page 44) was composed of children from superior home environment, and, due to the absence of the regular classroom teacher, after the first week reported for only five days. Here again "United States money" drops to fifth place, and the explanation is the same as for Table XI where the pupils handled much less money than children in other grades and classes. The items "reading numbers" and "counting" are here reversed, and inquiry brought out the fact that most of the pupils in this particular grade played more commercial games than counting games, such as "Hide and seek", and "I bounced my ball". It is also significant that only nine of the 17 arithmetical usages were used. "Measuring length", "multiplying whole numbers", "dividing whole numbers", "adding fractions", "measuring area", "dividing fractions", "subtracting fractions" and "multiplying fractions", were reported as not occurring.

Figure XII, Page 45, represents graphically the percentages as shown in Table XII.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 12. Showing for a Fourth Grade, (E)*, 34 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of One Week. Percentage of Total Figured for Each Item.

(1)		Frequency (2)	Percentages (3)
1.	Telling Time...............	551	26.721
2.	Using U.S. Money..........	211	10.232
3.	Counting..................	272	13.191
4.	Reading Numbers...........	314	15.227
5.	Writing Numbers...........	231	11.202
6.	Roman Numerals............	193	09.359
7.	Adding Whole Numbers......	140	06.789
8.	Measuring Length..........	0	.000
9.	Measuring Weight..........	78	03.782
10.	Subtracting Whole Numbers.	72	03.491
11.	Multiplying Whole Numbers.	0	.000
12.	Dividing Whole Numbers....	0	.000
13.	Adding Fractions..........	0	.000
14.	Measuring Area............	0	.000
15.	Dividing Fractions........	0	.000
16.	Subtracting Fractions.....	0	.000
17.	Multiplying Fractions.....	0	.000
	Total	2062	99.994

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

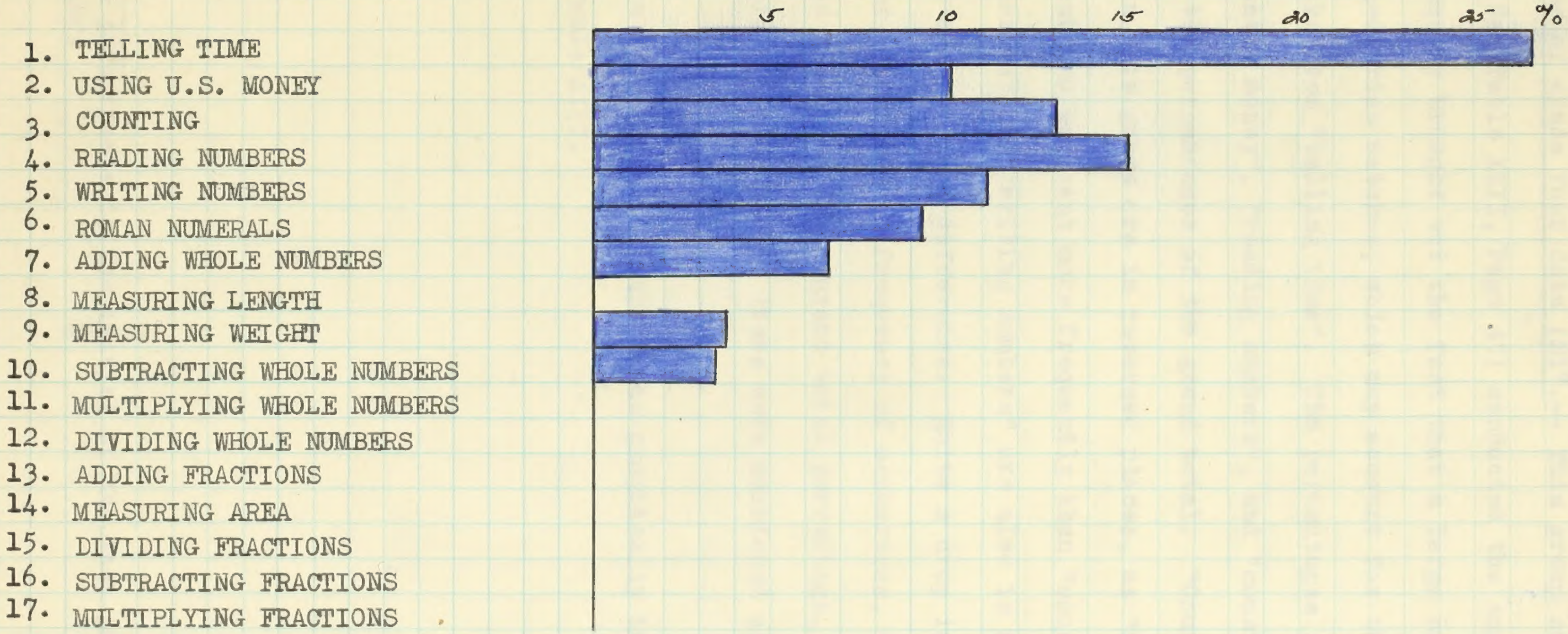

Figure 12. Showing graphically the items and percentage of Table X11, as pertaining to a fourth grade. (E)

Resume of grade four data (S)*.-- This group of 28 fourth grade children (See Table XIII, Page 47) conducted the experiment for two weeks. Inquiry brought out the fact that a large number of these pupils owned wrist watches, which may account for the higher percentage shown in the item "telling time". The percentages in the use of "United States money", "reading numbers", and "counting" follow quite generally the percentages of the grand total. "Counting" and "reading numbers" in this grade are in reversed places, as "reading numbers" occurs about two per cent more frequently than "counting". The items "Roman numerals" and "writing numbers" are also in reversed position with about one per cent difference. Quite a drop is noted after the fourth item "counting" in frequency of occurrence, thus following closely the practice of the grand total percentage. It is worth noting that in this grade only nine items were mentioned as being used by the children.

Figure XIII, Page 48, represents graphically the percentages as shown in Table XIII.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 13. Showing for a Fourth Grade, (S)*, 28 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

(1)	Frequency (2)	Percentages (3)
1. Telling Time...............	1958	33.401
2. Using U.S. Money..........	920	15.694
3. Counting..................	788	13.442
4. Reading Numbers...........	906	15.455
5. Writing Numbers...........	409	06.977
6. Roman Numerals............	471	08.034
7. Adding Whole Numbers......	219	03.735
8. Measuring Length..........	117	01.995
9. Measuring Weight..........	74	01.262
10. Subtracting Whole Numbers.	0	.000
11. Multiplying Whole Numbers.	0	.000
12. Dividing Whole Numbers....	0	.000
13. Adding Fractions..........	0	.000
14. Measuring Area............	0	.000
15. Dividing Fractions........	0	.000
16. Subtracting Fractions.....	0	.000
17. Multiplying Fractions.....	0	.000
Total	5862	99.995

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

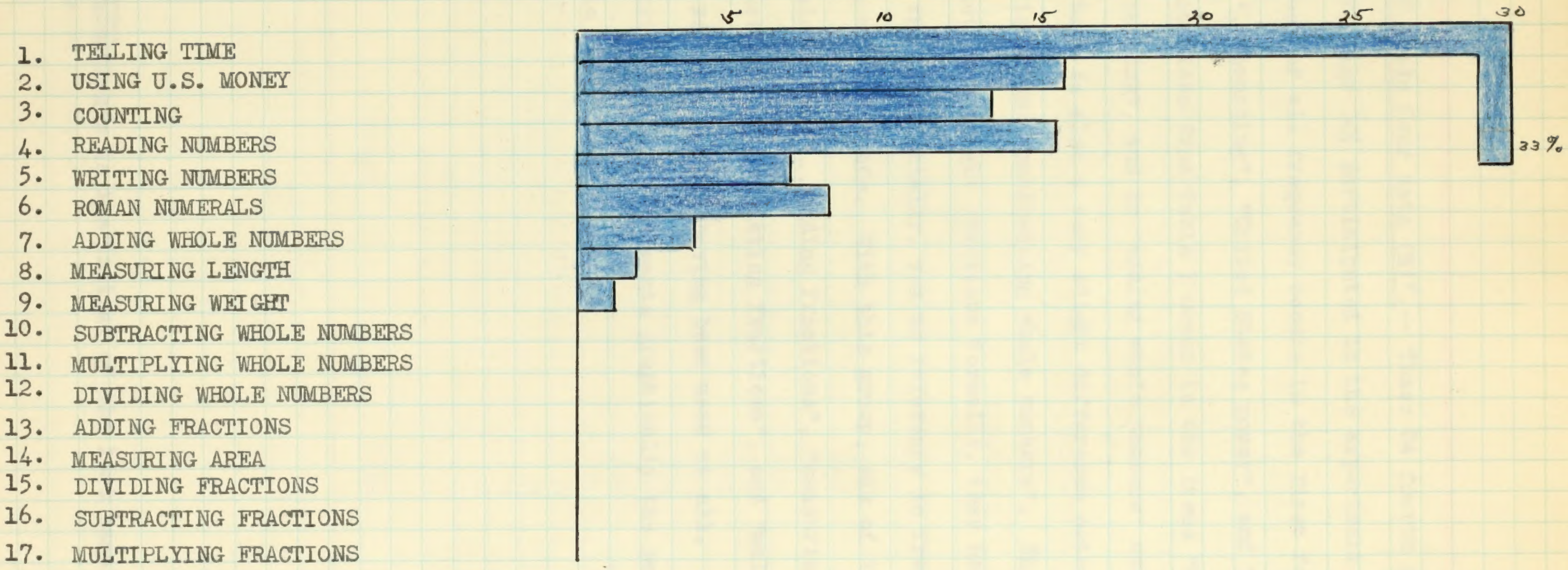

Figure 13. Showing graphically the items and percentage of Table XIII, as pertaining to a fourth grade. (S)

Resume of grade four data (N)*.-- These 34 fourth grade pupils (See Table XIV, Page 50) participated in the experiment for two weeks. Over 74 per cent of all frequency occurs in the first four items of "telling time", "counting", "United States money", and "reading numbers". Variations from Table I occur in the items "United States money" and "counting", and in "adding whole numbers" and "Roman numerals". There is also a very slight difference noted in the items "measuring weight" and "subtracting whole numbers". While fourth grade pupils have not been taught fractions formally, they have come in contact with them incidentally, yet no reference to fractions appears in the report of this grade. With this group, six of the 17 items, "dividing whole numbers", "adding fractions", "measuring area", "dividing fractions", "subtracting fractions", and "multiplying fractions", were reported as not having been used at all.

Figure XIV, Page 51, represents graphically the percentages as shown in Table XIV.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 14. Showing for a Fourth Grade, (N)*, 34 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time.................	1623	27.592
2. Using U.S. Money............	953	16.201
3. Counting....................	1059	18.004
4. Reading Numbers.............	726	12.342
5. Writing Numbers.............	570	09.690
6. Roman Numerals..............	290	04.930
7. Adding Whole Numbers........	318	05.406
8. Measuring Length............	134	02.278
9. Measuring Weight............	87	01.479
10. Subtracting Whole Numbers...	105	01.785
11. Multiplying Whole Numbers...	17	00.289
12. Dividing Whole Numbers......	0	.000
13. Adding Fractions............	0	.000
14. Measuring Area..............	0	.000
15. Dividing Fractions..........	0	.000
16. Subtracting Fractions.......	0	.000
17. Multiplying Fractions.......	0	.000
Total	5882	99.996

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

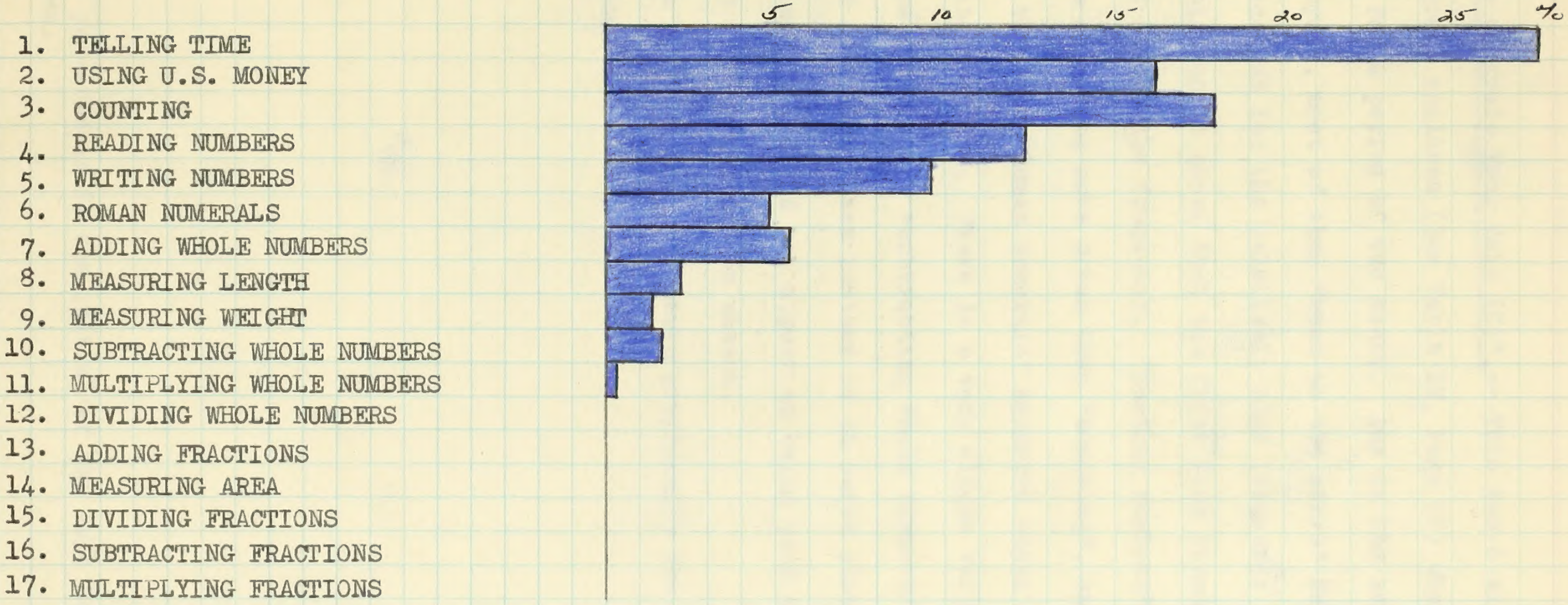

Figure 14. Showing graphically the items and percentage of Table XIV, as pertaining to a fourth grade. (N)

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Resume of grade four data (C)*.-- This was a slow moving group of 30 fourth grade children (See Table XV, Page 53) who conducted the experiment for a period of two weeks. Due to the economic environment of these pupils, most of them "went to the store" for their parents, which may account for the relatively high frequency of "United States money". This report shows that the first four items account for over 70 per cent of all the frequency. "Reading numbers" in this grade was reported as occurring more often than "counting", and the data also shows that the item "Roman numerals" occurred about two per cent more than "writing numbers". There is a very slight variation from Table I in the place occupied by "subtracting whole numbers", as in this grade it is found in eighth place instead of in tenth place as in Table I. Seven of the 17 items did not appear as being used at all, and again it is noted that fractions are absent.

Figure XV, Page 54, represents graphically the percentages as shown in Table XV.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 15. Showing for a Fourth Grade, (C)*, 30 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

(1)	Frequency (2)	Percentages (3)
1. Telling Time................	889	24.111
2. Using U.S. Money...........	685	18.578
3. Counting....................	487	13.208
4. Reading Numbers............	575	15.595
5. Writing Numbers............	263	07.133
6. Roman Numerals.............	336	09.113
7. Adding Whole Numbers.......	182	04.936
8. Measuring Length...........	89	02.413
9. Measuring Weight...........	80	02.169
10. Subtracting Whole Numbers..	101	02.739
11. Multiplying Whole Numbers..	0	.000
12. Dividing Whole Numbers.....	0	.000
13. Adding Fractions...........	0	.000
14. Measuring Area.............	0	.000
15. Dividing Fractions.........	0	.000
16. Subtracting Fractions......	0	.000
17. Multiplying Fractions......	0	.000
Total	3687	99.995

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

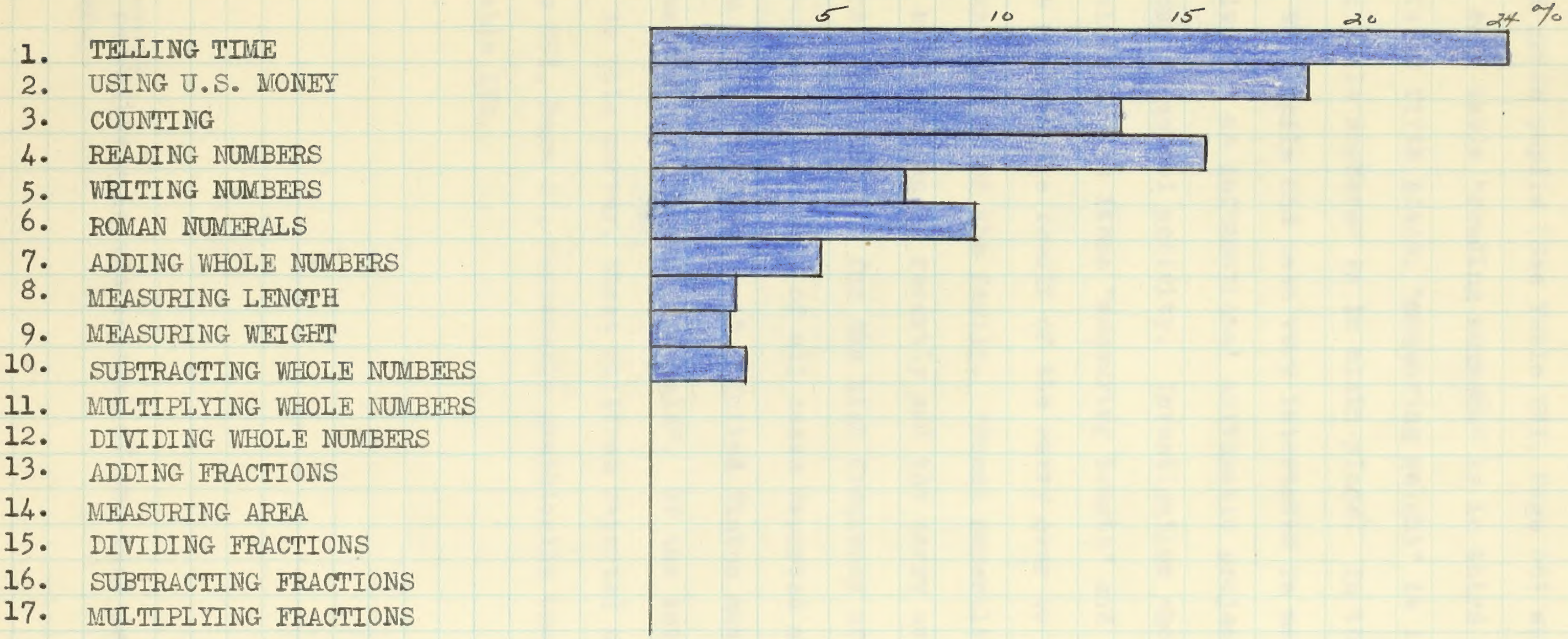

Figure 15. Showing graphically the items and percentage of Table XV, as pertaining to a fourth grade. (C)

Resume of grade three data (Q)*.-- This was a slow moving group of 28 third grade pupils (See Table XVI, Page 56) who reported for two weeks. In this table "reading numbers" is in third place, "Roman numerals" is in fifth place, "measuring weight" is in seventh place, and "adding whole numbers" is in ninth place. In this particular situation, the pupils had been very interested in measuring and weighing themselves in an informational arithmetic project and this carried over into out of school activity. Investigation showed that the frequency shown in the items "measuring length" and "reading numbers" was in some measure the result of the carry over to the home of measuring the height of the family. "Roman numerals" was another subject which had been taught recently and the carry over of this teaching was partly responsible for the high frequency of occurrence of this item. Over 83 per cent of all cases reported are accounted for in the five items "telling time", "United States money", "counting", "reading numbers", and "Roman numerals". Of the total number of 17 items used in this survey, these children reported using only nine.

Figure XVI, Page 57, represents graphically the percentages as shown in Table XVI.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 16. Showing for a Third Grade, (Q)*, 28 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

	Frequency	Percentages
(1)	(2)	(3)
1. Telling Time................	426	22.492
2. Using U.S. Money...........	363	19.165
3. Counting....................	246	12.988
4. Reading Numbers............	324	17.106
5. Writing Numbers............	126	06.652
6. Roman Numerals.............	237	12.513
7. Adding Whole Numbers.......	44	02.323
8. Measuring Length...........	45	02.372
9. Measuring Weight...........	83	04.382
10. Subtracting Whole Numbers..	0	.000
11. Multiplying Whole Numbers..	0	.000
12. Dividing Whole Numbers.....	0	.000
13. Adding Fractions...........	0	.000
14. Measuring Area.............	0	.000
15. Dividing Fractions.........	0	.000
16. Subtracting Fractions......	0	.000
17. Multiplying Fractions......	0	.000
Total	1894	99.993

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

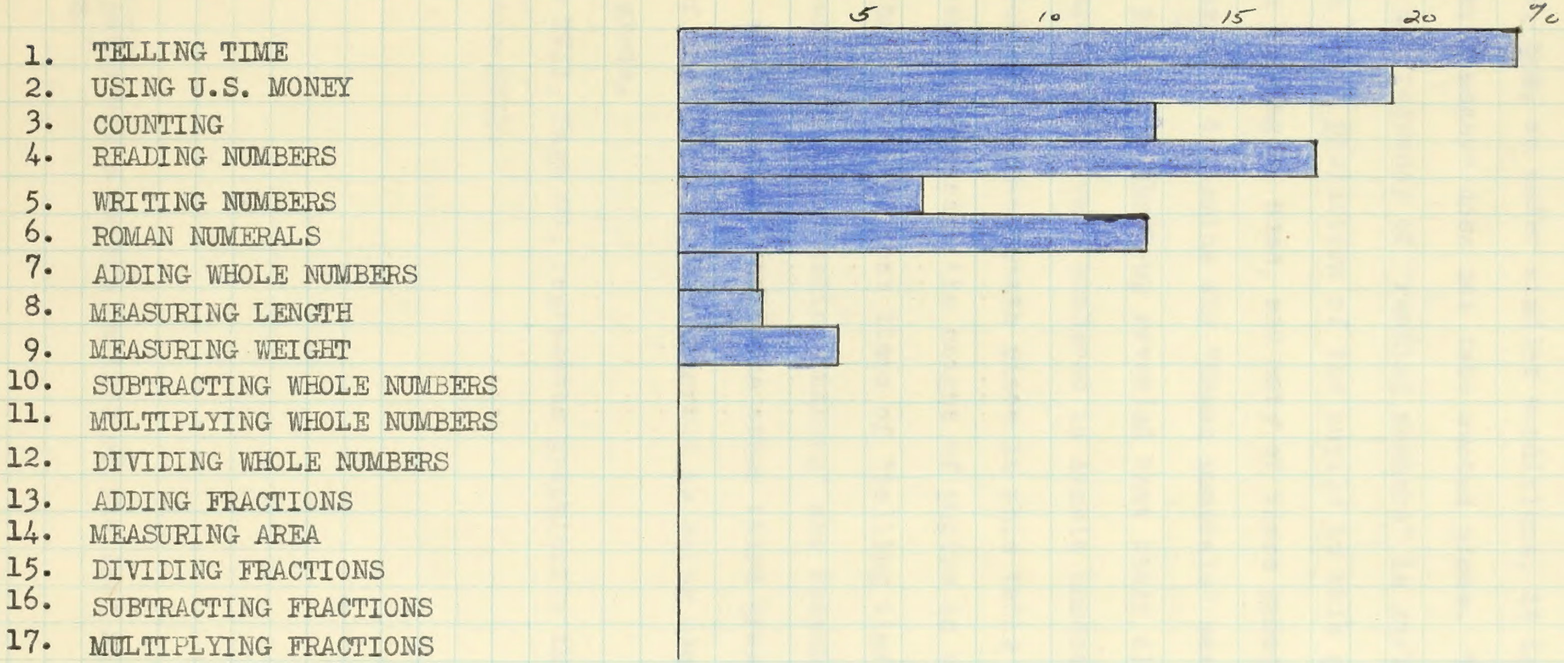

Figure 16. Showing graphically the items and percentage of Table XVI, as pertaining to a third grade. (Q)

Resume of grade three data (M)*.-- This class of 34 third grade children (See Table XVII, Page 59) came from a very good economic environment, and, as under similar conditions, it is found that "United States money" does not take second place. The relatively high percentage of frequency of "reading numbers" is partly due to the fact that a large proportion of the pupils in this grade use commercial games while playing at home, and many of these games are number games. In an endeavor to determine why "Roman numerals" was low in frequency (in eighth place), a check-up revealed that their clocks at home, with only four exceptions, were numbered in Arabic numerals. "Measuring length" which is found in sixth place in this table is another instance of carry over of measuring the height of pupils in school. It is noted here also that the first four items of "telling time", "United States money", "counting", and "reading numbers" are responsible for over 65 per cent of all uses. As in the other third grade (See Table XVI) only nine of the 17 items were reported as being used by the pupils of this third grade.

Figure XVII, Page 60, represents graphically the percentages as shown in Table XVII.

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

Table 17. Showing for a Third Grade, (M)*, 34 Pupils, the Frequency With Which Various Items Were Reported Used During a Period of Two Weeks. Percentage of Total Figured for Each Item.

(1)	Frequency (2)	Percentages (3)
1. Telling Time...............	693	25.622
2. Using U.S. Money...........	369	13.722
3. Counting...................	320	11.900
4. Reading Numbers............	407	15.153
5. Writing Numbers............	222	08.255
6. Roman Numerals.............	134	04.983
7. Adding Whole Numbers.......	182	06.768
8. Measuring Length...........	218	08.107
9. Measuring Weight...........	144	05.355
10. Subtracting Whole Numbers..	0	.000
11. Multiplying Whole Numbers..	0	.000
12. Dividing Whole Numbers.....	0	.000
13. Adding Fractions...........	0	.000
14. Measuring Area.............	0	.000
15. Dividing Fractions.........	0	.000
16. Subtracting Fractions......	0	.000
17. Multiplying Fractions......	0	.000
Total	2689	99.847

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*Letter in parenthesis is the initial of the last name of the classroom teacher.

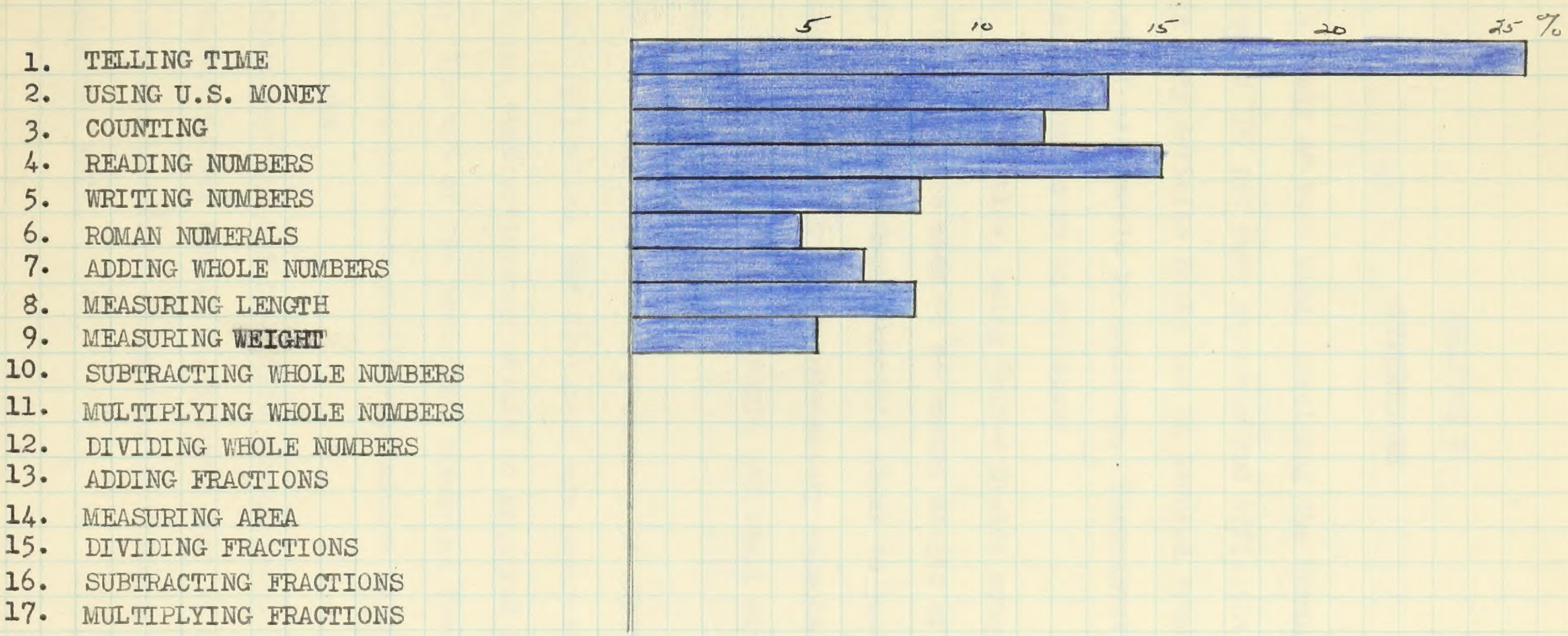

Figure 17. Showing graphically the items and percentage of Table XVII, as pertaining to a third grade. (M)

CHAPTER V

CONCLUSIONS

While a study of this kind, involving the human element, cannot be considered as 100 per cent accurate and efficient, yet it is felt that certain very definite facts can be deduced from this data concerning the usage of arithmetic by children. Throughout the experiment the following facts seem to be in evidence:

1. Telling time, using United States money, reading, and writing numbers seem to be common usages of children.
2. The use of Roman numerals seems to justify the teaching of this item in the elementary schools, for reading only.
3. Ability to measure length and small areas should be facilitated through practice.
4. The four fundamental processes of addition, subtraction, multiplication, and division, are apparently necessary, and 100 per cent efficiency should be acquired by pupils.
5. The use of the processes involving fractions seems to be confined to those pupils who indulge in domestic and practical arts.

This experiment did not take into consideration preparation of pupils for higher formal education, but was just an attempt to find out what phases and processes of arithmetic children actually use in their out-of-school life.

BIBLIOGRAPHY

1. Bibliography of Research Studies in Education, 1932-33, Bulletin No. 7, 1934.

2. Buckingham and MacLatchey, 29th Year Book of National Society of Study of Education, Chapter IV, pp. 473-524.

3. Buswell, G. T., "Selected References on Elementary School Instruction", Elementary School Journal, Vol. 35, p. 212.

4. Connor and Hawkins, "What Materials Are Most Useful to Children in Learning to Solve Problems?", Journal of Educational Method, October, 1936.

5. Dalrymple, Charles, "Frequency of Occurrence of Fractions in Industry", Master's Thesis, Boston University, 1932.

6. Fourth Yearbook, Department of Superintendence, National Educational Association, Chapter VII, 1926.

7. Journal of Educational Psychology, "The Child's Use of Numbers", pp. 462-467, 1919.

8. School and Society, "Arithmetic in the Schools", August 9, 1924.

9. Smith, Nila B., "An Investigation of the Uses of Arithmetic in the Out-of-School Life of First Grade Children", Elementary School Journal, April, 1924.

10. Stone, Mildred, "Methods of Teaching Arithmetic; a Partial Summary of Available Studies", Master's Thesis, Boston University, 1933.

11. Wahlstrom, Ebba L., "The Computational Arithmetic of Social Experiences of Third Grade Children", Journal of Educational Research, October, 1937.

12. Wilson, Dorothy Waters, "What Measures do People Know and Why?", Master's Thesis, Boston University, 1936.

13. Wilson, Guy M., "A Survey of the Social and Business Usage of Arithmetic", Contributions to Education No. 100, Teachers' College, Columbia University.

14. Wilson, Guy M., What Arithmetic Shall We Teach?, Houghton Mifflin Co., 1926.

BIBLIOGRAPHY (Concluded)

15. Wise, Carl T., "A Survey of Arithmetical Problems Arising in Various Occupations", Elementary School Journal, October, 1920.

GRADE_____

NAME________________ TEACHER________________

	MON.	TUES.	WED.	THURS.	FRI.	TOTAL
TELLING TIME						
ROMAN NUMERALS						
COUNTING						
READING NUMBERS						
WRITING NUMBERS						
ADDING WHOLE NUMBERS						
SUBTRACTING WHOLE NUMBERS						
MULTIPLYING WHOLE NUMBERS						
DIVIDING WHOLE NUMBERS						
ADDING FRACTIONS						
SUBTRACTING FRACTIONS						
MULTIPLYING FRACTIONS						
DIVIDING FRACTIONS						
USING U.S. MONEY						
MEASURING LENGTH						
MEASURING AREA						
MEASURING WEIGHT						
ANY OTHERS						

Exhibit 1. Showing the form used in gathering information from pupils.

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